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many foolish old farmers who attach no little importance to the state of the moon, the dark nights in November being a favourite season, without the really important considerations that the earth and the weather are in an appropriate and congenial state.

I have stated that the drills formed by the Suffolk drill-machine are very shallow; they are merely sufficient to afford about an inch of covering to the grain; but I have been assured by the best judges that the natural tendency of the cereal grains to strike their fibres is such that a heavy covering is unnecessary. *Our* national opinion is in favour of a heavy covering. and our wheat especially is actually imbedded deeply in the ground with a plough.

The practice in Great Britain universally is to *harrow in* the grain. The same practice is universally prevalent in France, where the land is left roughly harrowed (in the case of winter wheat), in order that the mouldering of the clods in spring may afford a kind of earthing to the plants, and prevent the running together of the earth in the wet winter months, as is too frequent on tenacious soils too finely harrowed.

It is not very long since the advantage of compressing the soil, for wheat in particular, was discovered in Buckinghamshire, by the accidental circumstance of a roller (which had been used for some different purpose) having been drawn in a zig-zag direction across a wheat field. The plants tillered better, looked far more vigorous during their advance to maturity, and yielded a far better return on the part of the field so distinguished by the course of the rollers, which soon after became a favourite implement in the culture of grain crops.

There is no doubt that all seeds are frequently sown with wasteful prodigality, because they are cheap or indifferent in quality. How much better then is it to have those of superior quality, though at a higher price, and to encourage the distribution of them in the soil by a careful *mode* of sowing!

Grains of corn of superior excellence are frequently selected with great care, as by Colonel le Couteur, in Jersey, and then sown with a dibble in seedling beds. The plants thus carefully treated tiller surprisingly, and produce accordingly; after two or three seasons, a fine variety, or a *renovation* of some previously established one, is obtained, and the seed is anxiously sought for.

Do any of our farmers ever dream of going through their corn fields in harvest, and thus obtain choice seeds? And yet what is there to prevent success in this respect? A poor farmer who cannot afford to purchase celebrated varieties at a high cost, may become his own seedsman, by care and assiduity, in an incredibly short time. Let some of our readers make the desired experiments for their own sakes.

SUSPENSION BRIDGES.

On the Theory of Suspension Bridges, with some account of their early history. By Mr G. F. FORDHAM. Read at the Scientific Society, March 12, 1840.

SUSPENSION BRIDGES appear to be of very ancient origin: travellers have discovered their existence in South America, in China, in Thibet, and in the Indian peninsula. They are most frequently met with in mountainous regions, and being suspended across a deep ravine, or an impetuous torrent, permit the passage of the traveller where the construction of any other kind of bridge would be entirely impracticable. Humboldt informs us that in South America there are numerous bridges of this kind formed of ropes made from the fibrous parts of the roots of the American agavey (*Agave Americana*). These ropes, which are three or four inches in diameter, are attached on each bank to a clumsy framework composed of the trunk of the *Schinus molle*; where, however, the banks are flat and low, this framework raises the bridge so much above the ground as to prevent it from being accessible. To remedy this inconvenience, steps or ladders are in these cases placed at each extremity of the bridge, by ascending which all who wish to pass over readily reach the roadway. The roadway is formed by covering the ropes transversely with small cylindrical pieces of bamboo. The bridge of Penipé erected over the Chamboo is described as being 120 feet long and 8 feet broad, but there are others which have much larger dimensions. A bridge of this kind will generally remain in good condition 20 or 25 years, though some of the ropes require renewing every 8 or 10 years. It is worthy of remark, as evincing the high antiquity of these structures, that they are known to have existed in South America long prior to the arrival of Europeans. The utility of these bridges in mountainous countries is placed in a striking point of view by the fact mentioned by Humboldt, of a permanent communication having been established between Quito and Lima, by means of a rope bridge of extraordinary length, after 40,000*l.* had been expended in a fruitless attempt to build a stone bridge over a torrent which rushes from the Cordilleras or the Andes. Over this bridge of ropes, which is erected near Santa, travellers with loaded mules can pass in safety.

But suspension bridges composed of stronger and more durable materials than the twisted fibres and tendrils of plants, are found to exist in these remote and semi-barbarous regions; in Thibet, as well as in China, many *iron* suspension bridges have been discovered. and it is no improbable conjecture that in countries so little known and visited by Europeans, others may exist, of which we have as yet received no accounts. The most remarkable bridge of this kind of which we have any knowledge in Thibet, is the bridge of Chuka-cha-zum, stretched over the Tehintchieu river, and situated about 18 miles from Murichom. Turner, in his Embassy to the Court of Thibet, says, "Only one horse is admitted to go over it at a time: it swings as you tread upon it, re-acting at the same time with a force that impels you every step you take to quicken your pace. It may be necessary to say, in explanation of its construction, that on the five chains which support the platform, are placed several layers of strong coarse mats of bamboo, loosely put down, so as to play with the swing of the bridge; and that a fence on each side contributes to the security of the passenger." The date of the erection of this bridge is unknown to the inhabitants of the country, and they even ascribe to it a fabulous origin. The length of this bridge appears to be about 150 feet.

Turner describes in the following terms a bridge for foot passengers of an extraordinary construction. "It was composed of two chains stretched parallel to each other across the river, distant four feet from each other, and on either side resting upon a pile of stones, raised upon each bank about eight feet high; they were carried down with an easy slope and buried in the rock, where, being fastened round a large stone, they were confined by a quantity of broken rock heaped upon them. A plank about eight inches broad hung longitudinally suspended across the river by means of roots and creepers wound over the chains with a slackness sufficient to allow the centre to sink to the depth of four feet below the chains. This bridge, called Selo-cha-zum, measured, from one side of the water to the other, 70 feet. The creepers are changed annually, and the planks are all loose; so that if the creepers give way in any part, they can be removed, and the particular part repaired without disturbing the whole."

Numerous suspension bridges formed of iron chains exist also in China; and though the accounts which travellers have transmitted respecting them are less detailed and explicit than would have been desirable, descriptions of two of them have been furnished, which are sufficiently minute and intelligible to excite considerable interest. The first to which I refer is contained in Kircher's China Illustrata. The following is a translation of the author's words: "In the province of Junnan, over a valley of great depth, and through which a torrent of water runs with great force and rapidity, a bridge is to be seen, said to have been built by the Emperor Mingus, of the family of the Hamæ, in the year of Christ 65, not constructed of brickwork, or of blocks of stone cemented together, but of chains of beaten iron and hooks, so secured to rings from both sides of the chasm, that it forms a bridge by planks placed upon them. There are 20 chains, each of which is 20 perches or 300 palms in length. When many persons pass over together, the bridge vibrates to and fro, affecting them with horror and giddiness, lest whilst passing it should be struck with ruin. It is impossible to admire sufficiently the dexterity of the architect Sinensius, who had the hardihood to attempt a work so arduous, and so conducive to the convenience of travelling." Another suspension bridge in this country is described in the 6th vol. of the "Histoire Generale des Voyages." The following is a translation: "The famous *Iron* Bridge (such is the name given to it) at Quay-Cheu, on the road to Yun-Nan (Junnan?) is the work of an ancient Chinese general. On the banks of the Pan-Ho, a torrent of inconsiderable breadth, but of great depth, a large gateway has been formed between two massive pillars, 6 or 7 feet broad, and from 17 to 18 feet in height. From the two pillars of the east depend four chains attached to large rings, which extend to the two pillars of the west, and which being connected together by smaller chains, assume in some measure the appearance of a net. On this bridge of chains a number of very thick planks have been placed, some means of connecting which, have been adopted in order to obtain a continuous platform; but as a vacant space still remains between this platform and the gateways and pillars, on account of the curve assumed by the chains, especially when loaded, this defect has been remedied by the aid of planking supported on trusses or consoles. On each side of this planking small pilasters of wood have been erected, which support a roof of the same material, the two extremities of which rest on the pillars that stand on the banks of the river." The writer proceeds to remark, that "the Chinese have made several other bridges in imitation of this. One, on the river Kin-cha-Hyang, in the ancient canton of Lo-Lo, which belongs to the province of Yun-Nan, is particularly known. In the province of Se-Chuen there are one or two others, which are sustained only by ropes; but though of an inconsiderable size, they are so unsteady and so little to be trusted that they cannot be crossed without sensations of fear."

While our attention is directed to early accounts and to the origin of suspension bridges, it may be proper to remark, that although, as we have seen, the inhabitants of the mountainous districts of South America, or the wild and barbarous regions of Thibet, appear to have been well acquainted with the purposes for which these structures are best adapted, and to have practised their construction from the most remote ages, neither the Greeks, the Romans, nor the Egyptians, according to all we know of those nations, had any knowledge of their uses or properties, or ever employed them as a means for crossing a river, or other natural impediment. It is not, therefore, from these celebrated nations of antiquity that the engineer has derived his first hints for the construction of suspension bridges, but from those rude and unpolished people, the results of whose ingenuity have just been described.

But it will now be interesting to inquire how far we can trace back the antiquity of suspension bridges in more civilized countries—on the Continent, in the British Isles, and in the United States of America. Scamozzi speaks of suspension bridges existing in Europe in the beginning of the seventeenth century, but it is very questionable if he employed that term to designate the same structure to which it is now applied; and this is rendered the more improbable, as no such bridges are now in existence, and other writers are totally silent upon the subject. It does not appear, then, that suspension bridges of other than recent erection have existed on the Continent, and in England the oldest of which we have any account has not been constructed more than a century. The first suspension bridge in the United States was erected in the year 1796. In England the oldest bridge of the kind is believed to have been the Winch Chain Bridge, suspended over the Tees, and thus forming a communication between the counties of Durham and York. Mr Stevenson (Edinburgh Philosophical Journal) expresses his regret at not having been able to learn the precise date of the erection of this bridge; from good authority, however, he concludes it to be about the year 1741. It may also be mentioned here, that at Carric-a-rede, near Ballintoy, in Ireland, there is a rope bridge, which in 1800 was reported to have been in use longer than the present generation could remember.

In the years 1816 and 1817, some *wire* suspension bridges were executed in Scotland, and, though not of great extent, are the first example of this species of bridge architecture in Great Britain. As, however, full descriptions of these bridges are to be met with elsewhere, it will not be necessary to notice them further.

In 1818, Mr Telford was consulted by government as to the practicability of erecting a suspension bridge over the Menai Strait, and was commissioned to prepare a design, if upon an examination of the localities he found the project feasible. Having accordingly surveyed the spot, he was led to propose the construction of a suspension bridge near Bangor Ferry, and in 1819 an act was obtained, authorising the erection of the bridge, a sum of money having been previously voted by Parliament for that purpose. This structure, which will always be regarded as a monument of the engineering abilities of Telford, was commenced in August 1819, and opened to the public on the 30th January 1826, having occupied six and a half years in its erection. The Union Bridge across the Tweed was designed and executed by Captain Brown, and was the first bar chain bridge of considerable size that was completed in this country. It was commenced in August 1819, and finished in the month of July 1820. After the completion of the Menai Bridge, bridges on the suspension principle began to be universally adopted throughout Europe; but it was not till *iron wires* had been proved to be more *firm* than bars *of a greater thickness* that these bridges received their most extensive applications. Since 1821, Messrs Sequin have constructed more than fifty wire bridges in France with the most complete success. The wire suspension bridge at Freyburg, in Switzerland, the largest in the world, was erected by Mons. Challey, and depends across the valley of the Sarine. It was commenced in 1831, and thrown open to the public in 1834. A suspension bridge has also been erected at Montrose, the size of which is scarcely inferior to that of the Menai Bridge. At Clifton a very large suspension bridge is now in progress of erection by Mr Brunel, and a suspension bridge of 1600 feet in length is about to be erected over the Danube, between Pest and Offen, the design for which is the production of Mr W. Tierney Clark, and under whose able superintendence its construction will be effected.—*Civil Engineer and Architect's Journal.*

REMONSTRANCE WITH THE SNAILS.

Ye little Snails,
With slippery tails,
Who noiselessly travel
Along this gravel,
By a silvery path of slime unsightly,
I learn that you visit my pea-rows nightly.
Felonious your visit, I guess!
And I give you this warning,
That, every morning,
I'll strictly examine the pods;
And if one I hit on,
With slaver or spit on,
Your next meal will be with the gods.

I own you're a very ancient race,
And Greece and Babylon were amid;
You have tenanted many a royal dome,
And dwelt in the oldest pyramid;
The source of the Nile!—Oh! you have been there.
In the ark was your floodless bed;
On the moonless night of Marathon
You crawl'd o'er the mighty dead;
But still, though I reverence your ancestries,
I don't see why you should nibble my peas.

The meadows are yours—the hedge-row and brook,
You may bathe in their dews at morn;
By the aged sea you may sound your *shells*,
On the mountain erect your *horn*;
The fruits and the flowers are your rightful dowers,
Then why—in the name of wonder—
Should my six pea-rows be the only cause
To excite your midnight plunder?

I have never disturbed your slender shells,
You have hung round my aged walk;
And each might have sat, till he died in his fat,
Beneath his own cabbage-stalk:
But now you must fly from the soil of your sires,
Then put on your liveliest crawl:
And think of your poor little snails at home,
Now orphans or emigrants all.
Utensils domestic, and civil, and social,
I give you an evening to pack up:
But if the moon of this night does not rise on your flight,
To-morrow I'll hang each man Jack up.
You'll think of my peas and your thievish tricks,
With tears of slime when crossing the *Styx*.

POSTSCRIPT.

If darkness should not let thee read this,
Furtive Snail,
Go ask thy friend, the Glow-worm,
For his tail.

—*From a Newspaper.*

That man should be happy, is so evidently the intention of his Creator, the contrivances to that end are so multitudinous and so striking, that the perception of the aim may be called universal. Whatever tends to make men happy, becomes a fulfilment of the will of God. Whatever tends to make them miserable, becomes opposition to his will.—*Harriet Martineau.*